

tion suggested an increased biological mobility of cesium-137 (a metabolic analog of potassium) stemming from the reduced availability of potassium (DOE 1995a).

4.1.2.2.3 Shut Down and Maintain

Refer to Section 4.1.2.2.2. This alternative would have essentially the same water flow as those described for the Shut Down and Deactivate Alternative; therefore, those impacts are likely to prevail under both alternatives.

4.1.3 GROUNDWATER

This section summarizes groundwater data available for the SRS (see Aadland, Gellici, and Thayer 1995; WSRC 1996f) and pertinent data about the areas of interest for this EIS. It describes the current knowledge base of groundwater conditions and character at the SRS and near L-Lake, including such issues as transmissivity, hydraulic conductivity, flow directions, quality, and usage.

4.1.3.1 Affected Environment

Two hydrogeological provinces underlie the SRS – the Piedmont Hydrogeologic Province, which is older, and the Southeastern Coastal Plain Hydrogeologic Province (see Figure 4-10). The Piedmont Province consists of the crystalline bedrock and consolidated sediments of the Triassic-age Dunbarton Basin. Aquifers in this province are generally not useful for domestic or industrial purposes. The Southeastern Coastal Plain Hydrogeologic Province consists of Cretaceous, Tertiary, and Quaternary age unconsolidated sands, silts, limestones, and clays, as described in Section 4.1.1.1. This province includes the formations that provide water for the SRS and the surrounding area. The Southeastern Coastal Plain Hydrogeologic Province contains the following aquifer systems for the southeast portion of the Site (youngest to oldest, see Figure 4-5); SRS-specific units are shown in parenthesis:

- Floridan aquifer system

- Meyers Branch confining system (Crouch Branch confining unit)
- Dublin aquifer system (Crouch Branch aquifer)
- Allendale confining system (McQueen Branch confining unit)
- Midville aquifer system (McQueen Branch aquifer)
- Appleton confining system (the base of the province)

Regional Hydrogeologic Setting

The Floridan aquifer system and the Meyers Branch confining system comprise approximately 550 feet (170 meters) of the nearly 2,000 feet (610 meters) of sediments that are the Southeastern Coastal Plain Hydrogeologic Province (Aadland, Gellici, and Thayer 1995). The Floridan aquifer system is the only hydrogeologic unit that the alternatives are likely to affect (see Aadland, Gellici, and Thayer 1995; WSRC 1996f). Figure 4-5 shows the correlation between the geological formations and hydrostratigraphic nomenclature.

The Floridan aquifer system includes two aquifers and one confining unit:

- Water table aquifer
- First confining unit
- First confined aquifer

Aquifer Units

The water table aquifer and the first confined aquifer are the focus of the groundwater analysis in this EIS because none of the alternatives would affect the other aquifers or the confining units (see Aadland, Gellici, and Thayer 1995; WSRC 1996f).

The water table aquifer is comprised of the Tobacco Road Formation, the Dr. Branch Formation, and the Clinchfield or Santee Formation. The first confining unit includes the

Clinchfield Formation, the Santee or Tinker Formation, and possibly the Warley Hill Formation, depending on the SRS area. The first confined aquifer [also known as the Gordon aquifer (Aadland, Gellici, and Thayer 1995)] might include the Congaree, Warley Hill, Fishburne, and possibly Williamsburg Formations, depending upon the SRS area. Section 4.1.1.1 contains descriptions of these sedimentary strata. Run-on and rainfall provide recharge to these units.

Groundwater Flow

Groundwater flow rates vary from several hundred feet to a few inches per year towards the onsite streams and swamps and eventually to the Savannah River. Groundwater movement is controlled by the incision depth of streams, most of which receive a significant contribution from groundwater. In addition, groundwater flow has a downward component to deeper aquifers at inter-stream areas (e.g., at L-Area and at P-Area). In some places it flows upward to shallow aquifers closer to streams (e.g., at F- and H-Seepage Basin Areas).

L-Area is situated above a groundwater divide, flowing either to Steel Creek or a Pen Branch tributary (Figure 4-11). The contaminated sites are located between the southeast side of L-Area and the northwest side of L-Lake. The shallow groundwater on this side of L-Area flows southeast toward the lake. Figures 4-11 and 4-12 are potentiometric maps of the water table aquifer and the first confined (Gordon) aquifer, respectively (from WSRC 1996f and Aadland, Gellici, and Thayer 1995, respectively).

Tables 4-1 and 4-2 list the principal hydrogeological properties of the water table aquifer and the first confined aquifer, respectively, for the three areas of interest.

Groundwater Quality

In most of South Carolina, including the SRS, the quality of the groundwater, is generally very good. The pH range for SRS groundwater is 4.9 to 7.7, and the water is generally soft. Con-

centrations of dissolved and suspended solids are low but iron concentrations are high in some aquifers (DOE 1995c).

TE The shallow aquifers at the SRS have been contaminated with tritium, metals, and industrial solvents; however, only 5 to 10 percent of the aquifer system is affected sitewide. Most of the L-Area contamination is associated with facilities where lead, radionuclides, and solvents are present in the water table aquifer (see Figure 4-13). L-Area, which is on the northwest shore of L-Lake, contains four Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) units several SRS reports have been prepared to describe its geology and soils and the related environmental issues for these areas. The water table aquifer outcrops above the current level of L-Lake but contamination from L-Area CERCLA units has not reached the point where the aquifer outcrops (WSRC 1996g). The first confined aquifer is not known to have been contaminated in any of the areas of interest for this EIS. Contaminant releases to the subsurface at SRS have not migrated offsite (DOE 1995c).

Groundwater Use

In the area surrounding SRS, groundwater is used for domestic and industrial purposes. DOE identified at least 56 major municipal, industrial, and agricultural groundwater users within 20 miles (32 kilometers) of the center of SRS for a total of 36 million gallons (140,000 cubic meters) per year (DOE 1987a). Groundwater is the only source of domestic water at the SRS, with treatment required for pH and iron. Almost every major operating area has groundwater production wells. The total SRS groundwater production is 9 to 12 million gallons (34,000 to 45,000 cubic meters) per day (Arnett, Mamatey, and Spitzer 1996). On the SRS, only the deeper aquifers provide drinking water and also water for some industrial uses. Off the Site to the north, the Water Table Aquifer is the source of drinking water and other municipal purposes (DOE 1987a). Southeast of

Table 4-1. Water table aquifer.

Property	L-Area ^a	SRS Streams and Par Pond ^b
Hydraulic conductivity	1.11 - 2.52 feet per day (0.34-0.77 meter per day)	16.4×10^{-2} - 39.37 feet per day (5.5×10^{-2} - 12.3 meters per day)
Porosity	0.20 - 0.25	0.20 - 0.25
Hydraulic gradient	0.011 - .013 foot per foot (0.0033-0.040 meter per meter)	Not reported
Transmissivity	Not reported	419.8-960.1 square feet per day (39.0 - 89.2 square meters per day)

a. Source: WSRC (1996g).
b. Source: WSRC (1996e).

Table 4-2. First confined aquifer.

Property	L-Area	SRS Streams	Par Pond
Hydraulic conductivity ^a	24 - 41 feet per day (7.32 - 12.5 meters per day)	24 - 41 feet per day (7.32 - 12.5 meters per day)	35 feet per day (10.67 meters per day)
Porosity ^a	Average - 33.5%, Range 26 - 38%	Average - 33.5%, Range 26 - 38%	Average - 33.5%, Range 26 - 38%
Transmissivity	GSA ^b : 1,292 - 2,562 square feet per day (120 - 238 square meters per day) ^c	GSA: 1,124 - 2,562 square feet per day (12,099 - 25,578 square meters per day) C-Area: 68.2 square feet per day (734 square meters per day)	Par Pond: 2,116 square feet per day (196.6 square meters per day) P-Area: 13,400 square feet per day (1,245 square meters per day)

a. Source: Aadland, Gellici, and Thayer (1995).
b. GSA = General Separations Area.
c. Source: WSRC (1996e).

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the Site the primary drinking water aquifers are the first confined aquifer and the deeper aquifers.

The current use of groundwater at K- and L-Areas is for the industrial and domestic water supply. K- and L-Areas each have two production wells, which produce from the lower portions of the Crouch Branch aquifer and the upper portions of the McQueen aquifer. These two aquifers are not contaminated in the area of interest and are prolific water producers at the SRS (Beavers 1996).

The wells at K-Area currently meet the demands of the facility. The wells have 500-gallon-per-

minute (0.032-cubic-meter-per-second) pumps but produce only 200 to 300 gallons per minute (0.013 to 0.019 cubic meter per second). The domestic water supply has been supplemented by the recent hookup to the sitewide water system. The two L-Area wells are producing at lower levels than originally designed but are meeting demands. One well is producing 200 to 300 gallons per minute with a 500-gallon-per-minute pump. The other well produces 100 gallons per minute (0.0063 cubic meter per second) on a 150-gallon-per-minute (0.0095-cubic-meter-per second) pump. The deeper aquifers at L-Area are capable of producing the water required to operate the facility if the River Water System were shut down (Beavers 1996).

4.1.3.2 Environmental Impacts

4.1.3.2.1 No Action

Under this alternative, DOE would maintain L-Lake in its current state. The water table aquifer gradient, level, and flow rate should remain constant because the L-Lake outfall would continue to discharge; therefore, the aquifer would maintain reservoir elevation. At L-Area, this alternative would not affect contaminants in this aquifer. Infiltration of water from the River Water System does not occur at L-Reactor but downgradient of L-Reactor at the L-Lake outfall and, therefore, would not mobilize contaminants in the water table aquifer. Because L-Lake and the first confined aquifer are not in direct communication at the lake, the continued operation of the River Water System would not affect groundwater conditions in the first confined aquifer.

Under the No-Action Alternative, the River Water System would provide fire protection water for K- and L-Areas. DOE would minimize the need for river water by using the existing pumps screened into the deeper aquifers (Crouch Branch and McQueen Branch) more under this alternative. However, the nature and character of these aquifers would not change. The net increased well water demand would be approximately 200 gallons per minute (0.013 cubic meter per second) for each area.

4.1.3.2.2 Shut Down and Deactivate

Under this alternative, DOE would allow L-Lake to drain. Because the water table aquifer conditions are currently influenced by L-Lake, groundwater gradients, levels, and flow rates probably would change. Calculations demonstrate the water table elevation at the L-Area Oil and Chemical Basin (one of four CERCLA units) would drop approximately 4 feet (1 meter), the local gradient would steepen and local velocities would increase approximately 12 percent (Halliburton NUS 1996). By lowering the level of water in the aquifer, a possible effect could be to strand

contamination within the vadose zone. If, in fact, the water table aquifer is homogeneous, then contaminant migration would be accelerated by the increased velocities. An earlier study indicated that the travel time from the L-Reactor seepage basin (another one of the four CERCLA units) would be 21 years to L-Lake compared to 18 years to natural Steel Creek level (DOE 1984).

Removal of the water from L-Lake would have little effect on groundwater elevation, gradient, flow rates, or flow direction in the first confined aquifer, which is not in direct communication with the lake or the water table aquifer. This aquifer contains no known contamination. River Water System outfalls do not directly influence the first confined aquifer, so discontinuation of the L-Lake outfall would have no effect on this aquifer. There is a possibility that the reduction of reservoir levels could influence the downward flow into the first confined aquifer below the dam.

As compared with the No-Action Alternative, this alternative would cause a further increase at K- and L-Areas in the demand for groundwater from the deeper aquifers of up to 200 gallons per minute (0.013 cubic meter per second) at each reactor area. Aquifer conditions would not change.

4.1.3.2.3 Shut Down and Maintain

The impacts discussed above for the Shut Down and Deactivate Alternative would apply to this alternative.

4.1.4 AIR RESOURCES

4.1.4.1 Affected Environment

4.1.4.1.1 Climate and Meteorology

The climate at the SRS is temperate, with short mild winters and long humid summers. Warm, moist maritime air masses affect the weather throughout the year (Hunter 1990).